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denied the "*existence*" of semi-permeable membranes in muscle nor have I ever discussed them in any publication. Neither have I denied the existence of such membranes, *because* proteins swell more in acids than in water. In fact, I see no cogent reason for even thinking of these two things as at all related to each other, wherefore the conclusion attributed to me by J. Loeb becomes entirely unintelligible, and appears, as a matter of fact, absolutely absurd. It is true that I have, at various times, lectured on the "*rôle*" of semi-permeable membrane in muscle, and, with many other physiologists and colloid-chemists, have come to the conclusion that these membranes play a much smaller part in the problem of water absorption than many physiologists formerly thought and J. Loeb still thinks. I still regard the rôle of osmotic processes in the problem of water absorption by muscle as only of secondary importance, yet even in my latest publication² I state that "I do not wish to uphold the somewhat extreme view that osmotic changes play no rôle whatsoever in the problem of water absorption by organisms." I know full well, moreover, that this position is regarded as too conservative by some of my colloid-chemical colleagues and as inadequate in the light of the newer developments of our knowledge.

These facts make it evident that J. Loeb is absolutely wrong in his statement that I have denied the existence of semi-permeable membranes in muscle, and still more wrong when he says that I have done this "on account of the fact that acid causes proteins to undergo imbibition." So far as *my* published thoughts regarding this question go, the statements in the article of J. Loeb, appear, as a matter of fact, not only, as he says, "superfluous," but wrong and misleading. The whole argument of J. Loeb is based upon an entirely arbitrary distortion of my views.

WOLFGANG OSTWALD

UNIVERSITY OF LEIPZIG,

August 5, 1916

² Wolfgang Ostwald, "Die Welt der vernachlässigten Dimensionen," 133. Dresden and Leipzig, 1915.

SCIENTIFIC BOOKS

Weather Forecasting in the United States.

By a Board consisting of ALFRED J. HENRY, EDWARD H. BOWIE, HENRY J. COX, HARRY C. FRANKENFIELD. Washington, 1916, Weather Bureau, No. 583. C. F. MARVIN, Chief. Pp. 370, 119 charts.

This volume of meteorological studies is timely in its appearance and creditable as to its contents. Time and again the question has been raised as to whether weather forecasting is entirely empirical or based on scientific principles within ordinary comprehension. Almost synonymously with these memoirs appeared the bulletins of the Carother's Observatory, Houston, Texas, on the correlation of solar and weather phenomena, with which system of long-time weather predictions Professor Willis Moore, former chief of the Weather Bureau, is associated. This observatory announces the issue, for each state, of long-time forecasts ranging from eleven to eighteen days in advance. These forecasts are based on variations in the solar radiation received by the earth, which are said to cause rotating cyclonic eddies in recurring periods of eighteen days. The Carother's method of forecasting is only one of several systems advanced by individual scientists in the United States, which seek public recognition as to the value of their theories and as to the accuracy of their weather predictions.

At times the U. S. Weather Bureau has issued forecasts for even a week in advance. It has remained for the Argentina service, beginning in 1915 under Professor Wiggins, to regularly issue forecasts for a week, indicating the temperatures for 8 A.M. and 8 P.M., as also the days on which rain is expected.

Since Professor Marvin, the chief of the Weather Bureau, has officially stated that systems of the Carothers and allied types are fallacious, it is of special importance that the general public should be definitely informed as to groundwork of the national weather forecasting. This system has been developed during the past forty-six years under the control and direction of Generals A. J. Myer, W. B.

Hazen, A. W. Greely, followed by Professors H. W. Harrington, Willis Moore and Charles F. Marvin. The theoretical evolution has been principally accomplished by a civilian staff, among whom may be mentioned Ferrel, Abbe, Maury and Humphreys, and the practical work by officers of the army, by observers and professors. The present force has risen from the lower grades through successful work of a quarter of a century or more to commanding positions.

This review does not discuss the relative merits of the various systems, official and non-official, but seeks to summarize with brief comments the accuracy or fulness of the official national methods herein presented, concerning which the public is not generally informed.

The reviewer prefaces his comments by stating that notwithstanding his open mind to scientific discoveries in meteorology, yet his views on long-time forecasts were formulated and published more than a quarter of a century since, in *American Weather*, N. Y., 1888. In this publication, the first American work wherein definite rules for forecasting were advanced, after quoting Blanford as to droughts and temperatures, the present writer found the sun-spot theory fallacious as to rainfall in the United States, but added:

The advances of meteorology are insufficient to justify predictions of the weather for a season in advance. There are apparently good grounds for believing that general laws can be deduced by which, from abnormal distributions of atmospheric pressure, to predict for prolonged periods in advance the general character of the coming season, as warm or cold, and wet or dry.

Almost without exception the authors of the various memoirs in weather forecasting have had practical experience in meteorological work with the Weather Bureau for thirty years, and so speak with a degree of authority that makes their opinions worthy of careful consideration.

The first essay, modestly styled Introductory Note, by Professor C. F. Marvin, sets forth clearly and succinctly the theory of atmospheric circulation, the essential basis of the

science of forecasting. His action in promptly initiating these investigations, in 1913, gives promise of further memoirs as later studies add to meteorological knowledge.

Professor W. J. Humphreys has brought together a comprehensive summary of existing knowledge as to winds, cyclones and anti-cyclones. He advances reasons as to why the average velocity of winds steadily increases to 600 meters' elevation, decreases to 1,000 meters, and after fluctuations steadily increases from 2,000 meters upward. In this connection he believes that:

The horizontal pressure gradient maintained by the temperature difference between adjacent regions is approximately constant with a tendency towards a maximum gradient at about 8 kilometers roughly.

In connection with the origin of cyclones and anti-cyclones Humphreys considers the various hypotheses: Ferrel's convectional, Hann's driven-eddy—both discussed by Professor Davis—and Mitham's counter-current. He believes that none of these theories contains clear and workable conceptions of "the origin, mechanism or maintenance of the extra-tropical cyclones," but that they "still remain the meteorological mysteries they have always been." He points out that tornadoes, "well-nigh peculiar to the United States east of the Rocky Mountains," develop usually in the southeast quadrant of a low-pressure area, the tornado being "a vigorous convection between strong neighboring counter-currents." He indicates the presence of permanent and semi-permanent low areas.

It is to be regretted that he did not consider in this connection the normal transfer to and from various regions, in the northern hemisphere of pressures from month to month, which, deduced largely from the international series of simultaneous observations, were charted and briefly described by the writer twenty-six years ago.

Coming to the practical problems, Professor A. H. Henry treats the subject under the head of weather forecasting, pressure changes, highs and lows, and forecasts in the Washing-

ton district. He outlines clearly the synoptic chart method, the basis of all American weather forecasts. The general control of the weather through atmospheric changes of pressure are shown, with their general course from west to east. Illustrating typical lows by charts, he indicates seven separate types: circular, secondary, V-depressions, cols or saddles, anti-cyclone, wedge-shaped and straight isobars. The result of such typical formations are discussed quite fully.

Speaking of the maps of temperature and pressure changes, the two most valuable charts in forecasting, an error is committed in speaking of them as made thrice daily. The writer reduced the observations from tri-daily to semi-daily about thirty years since—a great reduction in expense, much criticized at the time, but which did not reduce the efficiency of the service.

While the associations of high temperatures with low pressures, and of low temperatures with high pressures are noted, yet Henry frankly admits that allobars—the technical term for areas of pressure changes—remain a mystery. Forecasts from katallobars, areas of falling pressure, are considered under the headings: changes in form, greatest fall at center in twelve hours, and concentration of fall. While allobars are perfected in twelve hours in Canada, the time increases southward to thirty-six hours in the Gulf States. The memoir on highs and lows is quite complete. Henry points out that “the movement of lows seems to coincide with the seasonal direction of the planetary winds, of which they are doubtless a part,” and states that the “speed of lows varies directly with the strength of the general winds.” As to precipitation, in addition to other comments, he considers that “when the high is north or northeast of the low, the tendency to unsettled weather and precipitation in the regions between them is at a maximum.” The lows are considered by groups, according to their primary appearance, as follows: North Pacific, South Pacific, Alberta, Northern Rocky Mountain, and Colorado, Texas, East Gulf, South Atlantic. Highs are similarly treated.

Forecasting in the Washington district, by Henry, contains treatment of seasonal influences. He gives for Ohio five rules for warmer weather, and six for colder weather. It would have been most valuable if he had added similar rules for other states. As to the prolonged heated terms in the middle Western States Henry says:

They are probably due to fundamental causes in the general circulation, the nature of which we do not know.

They end with the disintegration of a southeastern high and the formation of a northwestern high.

Cold-wave forecasts are fully treated by Professor H. J. Cox, who finds the pressure-change charts far the most important element therefor. Cold waves usually occur through the rapid advance, with steep barometric gradients, of highs in rear of well-marked lows. Cox describes the various types of cold-waves, and sets forth the effect thereon by topography, especially by the Great Lakes and by the proximity of the ocean. Well-selected charts illustrate the formation and advance of such waves. He points out that atmospheric conditions for vast distances, even over an area of 4,000 sq. miles, are potent factors, through temperature, pressure, humidity, pressure gradients, cloudiness and snow-covered areas.

Supplementary to cold waves Cox discusses frost warnings, indicating the modifying influences of topography, especially in the shape of large bodies of water, moist soils and drained land. He also dwells on the different effects of fast and of low moving highs, the latter often producing frosts for successive nights. Dew-point readings in the evening are considered fallacious indications as to frosts, while humidity percentages have influences not clearly understood as yet.

Local peculiarities as to cold waves and frost-warnings, of much value and interest, are presented by Forecasters John W. Smith, of New England, L. M. Cline for the West Gulf, F. H. Brandenburg for Denver, E. A. Bealls for the North Pacific and G. H. Willson for the South Pacific. These experienced fore-

casters also present valuable data and opinions as to weather and temperature forecasts in their respective districts.

The subject of high winds is efficiently treated by Forecaster E. H. Bowie, who indicates the various types of pressure from which they occur. While pressure gradients induce high winds of definite relative force, yet exceptions to the rule are noted. Hurricanes, northers and blizzards receive due consideration. He mentions the intensity of action, caused by twelve different types of lows. Special supplementary treatment of the storm winds of the Atlantic and Gulf coasts is presented by Professor H. C. Frankenfield, and similar data for the North Pacific coast by Forecaster Bealls, for the South Pacific coast by Forecaster Willson, and for the Great Lakes by Professor Cox.

Professor H. C. Frankenfield discusses the forecasting of snow, of sleet and ice storms, dwelling especially on their seasonal and geographic distribution. He indicates seven distinct conditions precedent to sleet and ice storms, and five necessary conditions preceding fog formation. Similar treatment of thunderstorms comes from Professor Henry.

Forecaster Bowie in discussing long-range weather forecasts considers seasonal forecasts as improbable even in the near future. He indicates, however, sixteen types of pressure conditions in various regions of the northern hemisphere which enable meteorologists to forecast conditions, elsewhere consequent, from two days to two weeks in advance.

The bibliography and index are unsatisfactory, and most annoying to any student. There are about a score of publications referred to in the text which do not appear in the bibliography, while titles of small import are given place. This is a small matter, but it mars the publication.

As a whole, while these memoirs will be indispensable to every forecaster and experienced meteorologist, as far as the public is concerned they will be valuable only to advanced students of the science. They are quite beyond the scope indicated by Chief Marvin as a text-book or manual suitable for the guid-

ance and instruction of beginners. It is to be hoped that in due time there will appear a series of local manuals—not more than 24 pages in length—wherein should be presented such simple rules as would enable business men to still further utilize the daily weather map. The writer had a similar intent when he incorporated in *American Weather* twelve rules for general use in weather forecasting, which the board of professors has generously recognized in their preface. Doubtless a hundred similar rules—simpler and better—could be deduced by the experienced professors who have prepared these memoirs, whose value to students is recognized as of the highest order.

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SPECIAL ARTICLES

THE RESULTS OF EXTIRPATION OF THE ANTERIOR LOBE OF THE HYPOPHYSIS AND OF THE THYROID OF *RANA PIPPIENS* LARVÆ

THE writer has long been impressed with the desirability of testing the effects of extirpation of the glands of internal secretion at the very beginning of their development in order to determine the part that they play in the development and differentiation of the embryo. Of all the vertebrates the anurans seemed to offer the greatest opportunities for such work. Adler ('14)¹ performed experiments of this kind, but the operation was carried out at a late stage and consequently did not entirely exclude the early influence of the gland. Early in the spring of 1915 the writer removed the anlage of the anterior lobe of the hypophysis at the time of closure of the medullary folds by removing the surface ectoderm from which it would shortly afterwards develop. This attempt resulted in a large degree of mortality and was abandoned. This spring the operation was successfully accomplished by making a transverse frontal cut extending back the entire length of the fore brain and parallel to it a sufficient distance below to just expose the ventral surface of the hy-

¹ Adler, L., "Metamorphosestudien an Betrachierlarven. I. Extirpation endokriner Drüsen. A. Extirpation der Hypophyse." *Arch. f. Entwicklungsmech. d. Organ.*, Bd. 39, 1914.